

**UNITED STATES OF AMERICA  
BEFORE THE  
DEPARTMENT OF ENERGY,  
OFFICE OF ECONOMIC, ELECTRICITY  
AND NATURAL GAS ANALYSIS**

**COMMENTS OF THE  
ELECTRIC POWER RESEARCH INSTITUTE  
ON ELECTRIC RELIABILITY ISSUES**

Pursuant to the Notice of Inquiry (NOI) issued by the United States Department of Energy (DOE) <sup>1</sup> regarding the interstate electric transmission system and electric reliability issues, the Electric Power Research Institute, Inc. (EPRI) respectfully submits the following comments.

**I. Executive Summary**

EPRI supports DOE's efforts to address electric reliability issues in the context of the overall restructuring of the electric utility industry. As noted in the NOI, the interstate transmission grid is currently utilized in ways that were not originally contemplated. As a result, the reliability of the electric power grid has been diminished and increasing outages across the United States have had significant adverse consequences for regional economies and electric consumers.

In response to these concerns, EPRI has been implementing a number of research and development initiatives that would enhance reliability and ensure that consumers continue to be served in the most reliable and affordable manner possible. To achieve these objectives, it is critical that funding levels for EPRI's research initiatives increase. EPRI, therefore, urges DOE to: (1) promote reliability-related research and development initiatives as a necessary component of a national

reliability policy; and (2) adopt policies that encourage and facilitate the funding of EPRI's research.

## **II. Introduction**

EPRI is a non-profit, membership corporation incorporated in 1972 as the Electric Power Research Institute by U.S. electric utilities to manage a national, public/private, collaborative research program on behalf of EPRI members, their customers, and society. Today, EPRI has over 1000 members consisting of government-owned utilities (both federal and non-federal), rural electric cooperative associations, investor-owned utilities, Independent System Operators (ISOs), foreign (international) utilities, independent power producers, and governmental agencies engaged in funding electricity-related research and development. Newly formed Regional Transmission Organizations (RTOs) also are eligible to join EPRI. EPRI is a tax-exempt scientific organization under Internal Revenue Code Section 501(c)(3) and makes its research results available to the interested public on a non-discriminatory basis through its technology transfer program, including publication of reports, licensing of intellectual property, and sponsoring seminars and conferences.

In operation for more than 25 years, EPRI has gained a worldwide reputation for excellence and credibility in scientific research and technology development related to electricity. EPRI's current R&D program spans every aspect of power generation, delivery and use. In 2000, EPRI members could choose to participate in more than 100 different technical areas, referred to as annual research "targets," in five product sectors: Environment, Generation, Nuclear Power, Power Delivery, and

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<sup>1</sup> 65 Fed. Reg. 69,753 (November 20, 2000).

Retail. In addition, EPRI provides a Strategic Science & Technology Program for longer-term research and sponsors special R&D initiatives that are separate from the annual program offering. EPRI is part of a family of companies that includes a wholly owned, for-profit, technology services subsidiary and other affiliated entities.

One of EPRI's most important collaborative opportunities is the ongoing development of an Electricity Technology Roadmap, a comprehensive document exploring the opportunities for, and impediments to, electricity-based innovation over the next 25 years and beyond. Thus far, over 150 organizations have participated with EPRI and its members in this endeavor to increase electricity's value to society. EPRI has been leading this roadmapping effort to strengthen the value of public and private R&D investment for the benefit of society.

### **III. Reliability-Related Initiatives**

#### **A. The Need For Additional Reliability-Related Research and Development**

As the electricity industry undergoes its most fundamental restructuring in a century, the challenge of maintaining the reliability of the electricity system is growing. With dramatic increases in inter-regional bulk power transfers and accelerating complexity of transactions among parties, the electric power grid is being used in ways for which it was not originally designed. Grid congestion and unusual power flows are increasing at the same time as customer expectations of reliability are rising to meet the needs of a digital society. As a result, limitations of the current system are becoming apparent, manifested by increasing frequency of reliability problems, including outages affecting large numbers of customers at a huge cost to

society. For example, the widespread outage in the Western United States on August 10, 1996 has been estimated to have cost nearly \$1 billion.<sup>2</sup> Since then, several other major transmission and distribution system outages have occurred in various regions and urban areas, primarily during the summer months. In recent weeks, even during the winter season, California also has experienced limitations of the current power delivery system, with the California ISO declaring periodic Stage 2 and Stage 3 power alerts when reserve margins to serve current demand have fallen below certain levels.

These challenges to the reliability of today's transmission systems can be met through R&D and the application of advanced technologies. For example, power-electronic control and wide-area management technologies that are available or under development can help to alleviate the growing potential for outages, power interruptions, and operational constraints in an open-access electricity grid. The estimated 10-year funding requirement for strengthening the power delivery infrastructure, as recommended in EPRI's Electricity Technology Roadmap report, is \$1 billion.<sup>3</sup> Yet, the investment in the necessary R&D is not being made at sufficient levels by the industry. As a result of deregulation and restructuring, funding of collaborative R&D through EPRI has declined significantly from nearly \$500 million in 1995 to less than \$400 million in 2000. This includes especially sharp declines in funding of longer-term, strategic research from approximately \$200 million per year in 1995 to less than \$40 million in 2000.

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<sup>2</sup> Douglas, John, "Power Delivery in the 21<sup>st</sup> Century," EPRI Journal, (Summer 1999, p. 20.)

<sup>3</sup> "EPRI Electricity Technology Roadmap: 1999 Summary and Synthesis," July 1999, Vol. 1, Chapter 2, Table 2-1, page 39.

In August of 1999 EPRI held its annual Summer Seminar, a symposium of our Board of Directors and our outside Advisory Council, which was attended by representatives from public utility commissions, academia, and the federal government, as well as industry stakeholders. The seminar addressed "Issues and Innovations for 21<sup>st</sup> Century Reliability" and concluded that "North America is closer to the edge, in terms of the frequency and duration of severe power outages, than at any time in the last 35 years" and that the "root cause of this threat is the disincenting of investment" as a result of "uncertainty in both the institutional and market structure guiding the power delivery system." One of the recommendations resulting from the symposium concluded that EPRI should evaluate power system vulnerabilities, develop a forum to help individual utilities review evaluations and implement response plans, and ensure development of needed new technologies.

**B. EPRI's Power System Reliability R&D Efforts**

In response to those recommendations, EPRI established a separate initiative, the Reliability Enhancement Program, in addition to its ongoing Power Delivery research program. This initiative was formed in the Fall of 1999 to focus on understanding the root causes of recent outages and identify ways to reduce the risk of additional reliability problems during the next two years. The program includes a risk assessment of the nationwide transmission grid by North American Reliability Council (NERC) regions and has been endorsed by NERC, the Association of Edison Illuminating Companies, the IEEE Power Engineering Society, and chief executive officers of many utilities, both public and private. Since launching the initiative

approximately \$6 million has been raised for the program in which 63 utilities are participating.

In August 2000, EPRI's Summer Seminar focused on the evolution of the delivery system reliability challenge to the next level, "Creating the Infrastructure for the Digital Society." This symposium focused on the implications of the emerging Internet economy, which depends upon a server and fiber-optic based network that demands an extremely high level of power reliability and quality. The recommendations from this symposium emphasized the need to develop certain areas of electricity system infrastructure, including: (1) technology to enable increased capacity, reliability and functionality in high voltage transmission networks to support a stable wholesale power market; (2) improved real-time control of electricity distribution systems, plus new interconnection standards and real-time net metering capabilities to integrate distributed resources and facilitate differentiated services; (3) standardization of digitally-based electric energy devices and appliances; and (4) enabling the electricity service network to keep pace with the telecommunications transformation.

In response to these recommendations, EPRI is forming a Consortium for Electric Infrastructure to Support a Digital Society (CEIDS) as a public/private R&D collaboration to create and deploy technologies to ensure digital-quality electricity for society. This effort will address both the reliability and quality of power supplied by today's systems as well as the integration between consumers and the open market for electricity. The CEIDS initiative will be launched in the 1<sup>st</sup> Quarter of 2001. Its objective is to raise an aggregate of \$150 million from utilities, other private sector

entities, private foundations, and government agencies for a four-year technology development program.

The program is expected to encompass studies and technology for:

- Increasing capacity, reliability and functionality in high voltage transmission networks to support a wholesale power market, such as high temperature superconducting cables and storage technologies, post-silicon semiconductors, next generation Flexible AC Transmission System (FACTS) technologies, and high reliability power technologies such as uninterruptible substations and power quality parks;
- Improving real-time control of electricity distribution systems, including interconnection standards and real-time net metering capabilities to integrate distributed resources and facilitate differentiated services; demand-side response technologies; and
- Redesigning and standardizing digitally-based electric energy devices and appliances.

In addition to the Reliability Enhancement Program and the CEIDS initiative, EPRI's ongoing R&D program currently includes six targets focused on transmission system issues--Overhead Transmission, Underground Transmission, Substation Operation and Maintenance, Substation Assets Utilization, Grid Operations and Management, and Grid Planning and Development. EPRI also recently has designed a membership offering of R&D programs especially for the evolving RTO sector.

#### **IV. Conclusion**

In light of the above-described threats to the nation's power delivery system and the cost to society of under-investment in reliability-related R&D, a fundamental commitment to promoting and funding reliability-related research and development should be a critical component of DOE's national reliability policy. EPRI, therefore, urges DOE to adopt policies that would encourage and facilitate the undertaking and funding of EPRI's collaborative, reliability-related research and development initiatives by both the private and public sectors.

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